Homework No. 1

Due on April 5th

1. Design a 15-level uniform midtread quantizer for an input signal with a dynamic range of ± 10, and find the quantizer output value and the quantization error for an input signal of 1.2.

2. Given a uniformly distributed random variable over [-V,V]. Find an expression for the variance of this random variable.

3. The step size Δ of a uniform M-level quantizer is chosen for a uniformly distributed input over the interval $[-X_{max}, X_{max}]$. Find the SNR for this quantizer if the input is actually uniformly distributed over $\left[-X_{max}/2, X_{max}/2 \right]$.

4. Plot the rate distortion function of a memoryless Gaussian source with zero mean and unit variance subject to the squared error fidelity criterion.

5. Plot the rate versus distortion for uniform and nonuniform Gaussian quantizers with fixed length codes and with entropy coded outputs.

6. Verify the output entropy of an 8-level nonuniform quantizer for a Laplacian source subject to the squared error fidelity criterion.